transparent plate 2 (about 1 mm thick), e.g. of glass, silica or plastics, fixed together in parallel opposed and spaced relation, less than 1 mm apart, e.g. 0.1 mm apart, by bonding tracks 3 of suitable (e.g. epoxy) adhesive to form a capillary cell cavity 4, open at both ends, which communicates with the outside through a first discontinuity in the binding 3 arranged to form a cell aperture at side 5 of plate 1. Another discontinuity is present at the other end of bonding 3, to leave another aperture, to allow exit of air when a sample liquid is loaded into the cell. Plate 2 is larger than plate 1 and has a portion 6 extending away from the aperture. Portion 6 of plate 2 acts as a platform or threshold or lip onto which a drop of sample liquid can be applied, so that this liquid can be made to fill the capillary cell cavity 4 by capillary flow. Cavity 4 attracts and contains a definite and adequately reproducible volume of liquid when loaded in this way.

Attached to the inner surface of the capillary cell is a layer 7 including gel and other specific material relevant to the test procedure in which the capillary cell is to be used. In the example shown in the drawings the layer 7 is a patch of hydrogel including antibody, carrier on plate 2. There can be more than one such layer, e.g. a layer on plate 1 as well as plate 2, or a superimposition and/or side-by-side plurality of layers on either plate. Fir similar or other purposes, the layer 7 or other layer(s)m lining the internal surface(s) of the capillary cell can include an electically conductive layer or layers, as described in European Application No. 85304170.5 (EP 0 170 375), incorporated herein by reference, and in such a case conductive external connections can be provided by means of conductive tracks or connectors from the interior of the cell, if desired, passing between bonding layer 3 and the surface of the plates. These can for example be made in a manner known per se and used in the conventional surface fabrication of conductive tracks as often employed in the manufacture of semiconductors and liquid crystal displays.

When the cell is intended for making optical measurements, either plate 1 or plate 2 or both should be transparent or translucent.

The section shown as Figure 1 presents plates 1 and 2 spaced apart because the line of section does not extend through the bonding tracks 3.

The fabrication of a plurality of cells such as that of Figures 1-2 is illustrated by Figure 3, a fragmentary plan diagram showing an intermediate stage in the manufacture of such cells. A large plate 8 of glass or other material to make plates 2 is cleaned and coated in an appropriate way with patches of material 7 of the kinds described above as well as tracks of bondable adhesive 3. A second plate, not shown, is then adpressed to plate 8, optionally after forming on it bonding tracks corresponding to track 3, and optionally after forming patches or tracks of any other desired material, and the adhesive is cured. Then the assembly is broken or cut along lines shown as dotted lines 9 in Figure 3, and corresponding lines in the upper plate (not necessarily in registration with lines 9, though). The result is to give cells like the cells shown in Figures 1-2.

Further modifications and variations of devices according to the invention can be for example as discussed in European Patent Application No. 85304169.7 (EP 0 171 148).

The composite material provided by this invention, comprising gels carried on for example macro-solid phase materials, e.g. slides, beadlet, strip, tube, rod, peg or stick material, can be stored and presented to the user either in wet form or in dry rehydratable form. In either case, chemical/biological preservative can be included in the gel material, as well as any desired test reagents. Auxiliary test reagents can additionally/alternatively be present in or on any desired other part of the solid phase that carries the gel, e.g. as a film or printed spot or patch or impregnated fibrous or membranous material, e.g., filter material of cellulosic or synthetic polymer material. All or part of the materials may be stored and presented in hermetically sealed form, e.g., within a sealed foil wrapping or closure or within an appropriately sealed or closed container within which the test reactions are to be carried out.

The skilled reader will understand that the features mentioned and cited in this description and the claims, together with those of each of the cited European patent applications, are disclosed and may be used in any combinations, subcombinations and permutations.

Claims

1. Apparatus for carrying out a microchemical test, comprising a solid substrate having a surface which carries a polymer hydrogel formed in situ thereon and covalently bonded thereto.

2. Apparatus according to claim 1, wherein said gel is in contact with a material conferring microchemical analytical specificity on said apparatus.

3. Apparatus according to claim 2, wherein said gel carries an immunological reagent which is a ligand or a binding agent therefor.

4. Apparatus according to claim 2, wherein said gel is crosslinked and said ligand or binding agent is a macromolecule occluded within said gel.

5. Apparatus according to claim 3, wherein said ligand or binding agent is covalently bonded to said gel.

6. Apparatus according to claim 1, comprising a siliceous substrate surface-coated with an organic trialkoxy silane derivative which carries an organic functional group conjugated with a mer of the polymer hydrogel.

7. Apparatus according to claim 6, wherein the polymer hydrogel is a cross-linked acrylic polymer hydrogel covalently linked to said surface by polymerisation in situ via residues of said organic trialkoxysilane carrying residues of amino-alkyl or epoxyalkyl or acryloyl groups and optionally carrying organic functional groups derived from comonomers which are copolyme-

risable with acrylic monomers and which comprise N- hydroxysuccinimidyl, hydroxyethyl, carboxyl or aldehyde groups.

8. Apparatus according to claim 1, wherein said solid substrate is a plate carrying a layer of said gel thereon.

9. Apparatus according to claim 8, wherein said gel is carried on an internal surface of a capillary-fill cell formed by two closely-spaced parallel plates.

10. Apparatus according to claim 1, wherein said surface of said solid substrate carries material in contact with said gel and forming an electrochemical electrode.

11. Apparatus according to claim 1, wherein said gel carries at least one enzyme and at least one ligand or receptor therefor, optionally with a chromogenic or fluorogenic enzyme substrate occluded within said gel.

12. A process for producing a gel carried on a surface of a solid substrate, which comprises:

(a) activating the surface of the substrate to provide covalently-attached functional groups which are capable of reacting with a polymerising monomer, and

(b) poymerising a polymerisable monomer solution in a layer in contact with said activated surface, thereby to form in situ a layer of polymer gel covalently linked to said surface.

13. A process according to claim 12, wherein the monomer solution is an aqueous preparation of polymerisable acrylic monomer.

14. A process according to claim 13, wherein a ligand or specific ligand binding agent is present in the aqueous monomer preparation.

Fig. 1.

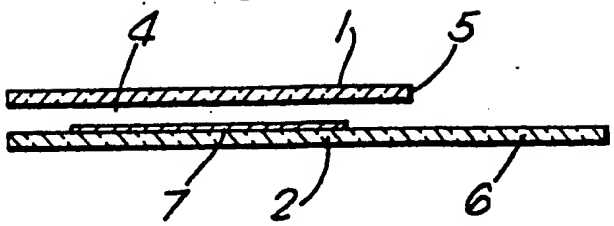


Fig. 2.

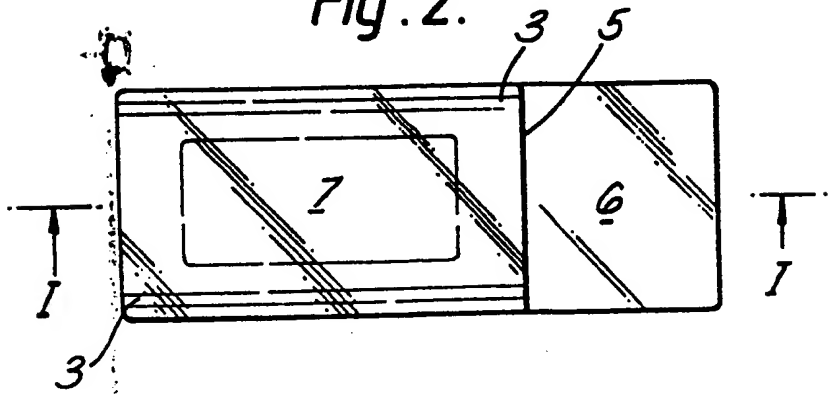
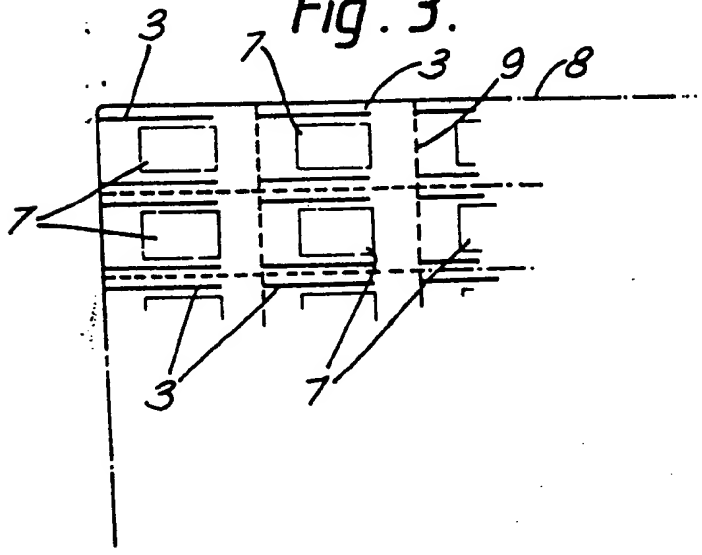


Fig. 3.



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(54) Materials and methods for microchemical testing.

(57) Apparatus for carrying out a microchemical test, comprising a solid substrate having a surface which carries a polymer hydrogel formed in situ thereon and covalently bonded thereto, for example with the gel in contact with a metal conferring microchemical analytical specificity on the apparatus, e.g. an immunological reactant or an electrode. For example, such a gel in a layer carried within a capillary-fill cell can be used for optical immunoassay.

EP 0 226 470 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 86 30 9709

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
P,D A	EP-A-0 171 148 (UNILEVER PLC)		G 01 N 33/543// C 12 M 1/40 G 01 N 33/52
P,A	WO-A-8 601 902 (UNILEVER PLC)		
A	US-A-3 793 445 (S.J. UPDIKE et al.)		
A	GB-A-2 014 727 (SANYO CHEMICAL INDUSTRIES LTD)		
A	FR-A-2 364 447 (GIST-BROCADES NV)		
A	US-A-3 975 511 (VANN et al.)		
A	FR-A-2 476 125 (KURARAY CO. LTD)		
D,A	BIOCHEMISTRY, vol. 14, no. 7, 1975, pages 1535-1541; R.I. SCHNAAR et al.: "Polyacrylamide gels copolymerized with active esters. A new medium for affinity systems"		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

G 01 N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	04-03-1989	CARTAGENA Y ABELLA P.

CATEGORY OF CITED DOCUMENTS

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